

REMARKS/ARGUMENTS

Claims 7-14, 16-21 and 23-33 have been examined. Claims 7, 19, 21, 23, 26, 27, 28, 30, and 33 have been amended and claims 16, 17, and 29 have been canceled. Hence claims 7-14, 18-21, 23-28, and 30-33 are now pending. Reconsideration of the subject application as amended is respectfully requested.

Claims 7, 11-14, 16-21 and 23-33 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Shang et al. (EP 0 697 467) in view of Littau et al. (WO 99/02754).

Claims 8-10 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over Shang et al. in view of Littau et al. as applied to claims 7, 11-14, 16-21, and 23-33 above, and further in view of Shang et al. (U.S. 5,788,778).

CLAIM REJECTIONS UNDER 35 U.S.C. § 103

Independent claim 7, as amended, provides a method of cleaning a semiconductor processing equipment. The method includes, *inter alia*, introducing a first precursor to a dissociator and introducing a second precursor comprising oxygen into the equipment. The second precursor bypasses the dissociator. The oxygen combines with carbon on the equipment to form CO₂. Such a method is neither disclosed, taught, nor suggested by the cited art.

The European Shang reference appears to disclose a remote chamber outside the deposition chamber for forming a reactive species, and flowing the reactive species into the deposition chamber to clean the inside of the deposition chamber. (See Abstract). Shang further notes "there may also be a source of a minor carrier gas". The minor carrier gas aids in the transport of the activated species to the deposition chamber. The minor carrier gas can be any appropriate non-reactive gas. Shang makes passing reference to oxygen as a possible carrier gas and also briefly notes that the carrier gas may also assist in the cleaning process, without providing any details whatsoever as to how that may occur. Shang fails to provide any teaching on the use of oxygen for cleaning within the chamber. In fact, Shang is using the carrier gas largely as a non-reactive gas to facilitate transport of the reactive species to the deposition chamber. The current independent claim 7 requires that the oxygen combine with carbon on the

equipment to form CO_y. Such a process is neither disclosed, taught, nor suggested by Shang. Further, Shang discloses cleaning chambers that have been deposited with silicon, doped silicon, silicon nitride, and silicon oxide. (See col. 6, lines 26-29). Thus, there is no teaching to clean carbon from the equipment. For at least these reasons, independent claim 7 is allowable over the cited art. Claims 8-14 depend from claim 7, and are allowable for at least depending from an allowable independent claim.

Independent claim 18 provides a method of cleaning a semiconductor processing equipment including, *inter alia*, introducing first and second precursors to a remote dissociator, and dissociating the first and second precursors into first and second plurality of radicals. Both the first and second plurality of radicals are introduced into the equipment. In contrast to claim 18, the cited art fails to disclose, teach or suggest such a method. In particular, Shang, taken alone or in combination with the other cited references, fails to disclose, teach or suggest the dissociation of more than one precursor for the cleaning of the deposition chamber. In contrast claim 18 specifically requires two separate precursors be dissociated and introduced into the equipment for cleaning thereof. As a result independent claim 18, and dependent claims 19 and 20 thereto, are allowable over the cited art.

Claim 21 provides a semiconductor equipment cleaning system having a remote dissociator configured to dissociate two distinct gases (a first gas and a third gas). The system includes a computer readable program comprising instructions directing the remote dissociator to dissociate both the first and third gas, and control the gas delivery system to introduce a portion of both the first and third gas (and the second gas) into the housing. For at least the reasons discussed in conjunction with independent claim 18, claim 21 is allowable. The cited art fails to disclose, teach or suggest the dissociation of two distinct gases for the cleaning process.

For at least the reasons described in conjunction with claims 18 and 21, independent claim 23 is allowable. Claim 23 provides a method for cleaning a deposition chamber that includes dissociating first and second precursor gases into first and second plurality of radicals that are different from one another. The first and second plurality of radicals are flowed into the deposition chamber for the cleaning process. Again, the cited art fails to disclose, teach or suggest the dissociation of multiple gases for the cleaning of the deposition

chamber or semiconductor equipment. As a result independent claim 23 is allowable over the cited art.

Claims 24-27 are allowable for at least depending from an allowable independent claim 23 and for the further novel features claimed therein. For example, dependent claim 26 provides further limitation with respect to dissociating at least part of the less reactive elements in the deposition chamber prior to flowing a portion of the second plurality of radicals into the deposition chamber. Similarly, claim 27 further provides for dissociating at least part of the less reactive elements in the deposition chamber after flowing a portion of the second plurality of radicals into the deposition chamber. The specific order of dissociation and flowing, as claimed in dependent claims 26 and 27, is neither disclosed, taught, nor suggested by the cited art. Thus, these dependent claims are allowable for at least these additional reasons.

Independent claim 28 provides a method for cleaning a deposition chamber contaminated with carbon and silicon based contaminants. In particular, the method is directed to cleaning a deposition chamber contaminated with a BLO_K residue. Such a particular method is neither disclosed, taught, nor suggested by the cited art, and claim 28 is in condition for allowance. In particular, the cited art fails to disclose BLO_K residue being cleaned from semiconductor equipment or a deposition chamber, and as noted above Shang fails to teach cleaning of carbon at all. Claims 30-32 depend from claim 28 and are allowable for at least this reason as well as for the additional novel features contained therein.

Independent claim 33 provides a computer readable storage medium having a computer readable program embodied therein. The program includes instructions for operating a semiconductor cleaning system, and in particular for delivering first and second precursor gases into a remote dissociator, and dissociating the two precursor gases into first and second plurality of radicals. The first and second plurality of radicals are adapted for reacting with different chemical compounds on the equipment. For at least the reasons discussed in conjunction with prior independent claims, claim 33 is in condition for allowance. In particular, Shang fails to disclose, teach, or suggest the dissociation of multiple gases for the cleaning of the equipment.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 303-571-4000.

Respectfully submitted,



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